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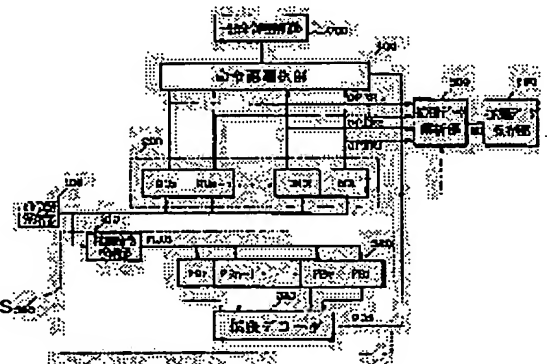
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## (54) DEVICE FOR CONTRACTING EXTENDED INSTRUCTION WORD

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a device for contracting extended instruction words, where fetch and decode of common instruction words are executed, and extended instruction words can be processed simultaneously, thereby heightening efficiency of a CPU and program.

**SOLUTION:** The device for contracting extended instruction words is composed of a storing section for instruction words in which the instruction words consisting of many common words and extended words are stored, a temporarily storing section which pre-fetches many instruction words from the storing section and stores them, a searching section for instruction words which outputs a position signal indicating a position of the common words and the position of the sequential extended words, a selecting section for instruction words which selects a buffer in which the common words are stored with use of the position signal, then outputs the common words sequentially, an analyzing section for common instruction words which executes the common words, an analyzing section for extended data which executes operation of operands of the sequential extended words and outputs extended data, and a storing section for extended data which receives the extended data and stores the same.



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**CLAIMS**

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[Claim(s)]

[Claim 1] In the central processing unit which carries out extended instruction word for using the data which are the address of a larger constant value than the magnitude of instruction word, or preservation equipment An instruction word preservation means by which the instruction word which consisted of much general instruction word and extended instruction word was saved, The extraordinary preservation means which consisted of many buffers which prefetch and save much instruction word from the above-mentioned instruction word preservation means, The instruction word of a large number prefetched from the above-mentioned instruction word preservation means to the above-mentioned extraordinary preservation means is received. An instruction word retrieval means to output the position signal which shows the location of general instruction word, and the location of one or more continuous extended instruction word among the instruction word which decoded the received instruction word and was saved for the above-mentioned extraordinary preservation means, The inside of the instruction word which received the position signal which is the output of the above-mentioned instruction word retrieval means, and was saved by the position signal at each buffer of the above-mentioned extraordinary preservation means, An instruction word selection means to choose the buffer where general instruction word was saved, and to output general instruction word one by one, A general instruction word analysis means to output many control signals for receiving the general instruction word outputted from the above-mentioned instruction word selection means, and performing general instruction word, The inside of the instruction word which received the position signal which is the output of the above-mentioned instruction word retrieval means, and was saved at each buffer of the above-mentioned extraordinary preservation means, An extended data analysis means to receive the operand of one or more continuous extended instruction word, to carry out data processing of the received operand, and to output extended data, Extended instruction word contraction equipment characterized by having an extended data storage means to receive the extended data which are the output of the above-mentioned extended data analysis means, and to save this.

[Claim 2] The above-mentioned instruction word retrieval means receives the instruction word prefetched from said instruction word preservation means to the above-mentioned extraordinary preservation means. An extended instruction retrieval means to judge whether each instruction word prefetched to the above-mentioned extraordinary preservation means is general instruction word, or it is extended instruction word, and to output a flag signal, As opposed to each instruction word which received the flag signal which is the output of the above-mentioned extended instruction retrieval means, and was saved at many buffers of the above-mentioned extraordinary preservation means The flag register which consisted of flag bits of a large number which show whether it is extended instruction word or it is general instruction word, Many flag bits of the above-mentioned flag register are judged. The inside of many buffers of the above-mentioned extraordinary preservation means, Extended instruction word contraction equipment according to claim 1 characterized by having the extended decoder which outputs the position signal which shows the location of a buffer where general instruction word was saved, and the location of a buffer where at least one or more continuous extended instruction word was saved.

[Claim 3] The above-mentioned extended data analysis means inspects one or more [ which was saved at many buffers of the above-mentioned extraordinary preservation means ] continuous extended instruction word in order of the order of appearance, and receives each extended instruction word. If it is the extended instruction word of an eye after the general instruction word using extended data most and extended instruction word is the extended instruction word which continues with former extended instruction word To the lower bit of extended data, fill the operand of extended instruction word, and it fills with the same value as the most significant bit of the operand of extended instruction word from the number of bits of the operand of extended instruction word to the extended data of a high order bit. If extended instruction word is the extended instruction word which continues with former extended instruction word Extended instruction word contraction equipment according to claim 1 characterized by filling the operand of extended instruction word to the lower bit which only the number of bits of the operand of extended instruction word made move the extended data generated before to the bit of a high order, and is vacant.

[Claim 4] The above-mentioned extended data-analysis means is extended instruction-word contraction equipment according to claim 1 characterized by to fill the operand of extended instruction word to the lower bit which inspected one or more [ which was saved at many buffers of the above-mentioned extraordinary preservation means ] continuous extended instruction word in order of the order of appearance, and only the number of bits of the operand of extended instruction word made move extended data to the bit of a high order to each extended instruction word, and is vacant.

[Claim 5] The extended data which are the output of the above-mentioned extended data analysis means are extended instruction word contraction equipment according to claim 1 characterized by being data which added together the operand of one or more continuous extended instruction word.

[Claim 6] The extended data which are the output of the above-mentioned extended data analysis means are extended instruction word contraction equipment according to claim 1 characterized by being data which shifted the operand of one or more continuous extended instruction word to right-hand side.

[Claim 7] When the position signal which is the output of the above-mentioned instruction word retrieval means is received and general instruction word is outputted to the above-mentioned instruction word selection means from the above-mentioned extraordinary preservation means, the above-mentioned extended data analysis means From the buffer where one or more continuous extended instruction word was saved among the instruction word saved at each buffer of the above-mentioned extraordinary preservation means Extended instruction word contraction equipment according to claim 1 characterized by receiving the operand of the extended instruction word saved at the buffer concerned, and carrying out data processing of an operand.

[Claim 8] The above-mentioned instruction word selection means is extended instruction word contraction equipment according to claim 1 characterized by outputting the instruction word which will not carry out any operation, either, if there is no general instruction word among the instruction word saved at each buffer of the above-mentioned extraordinary preservation means to the above-mentioned general instruction word analysis means.

[Claim 9] The above-mentioned extraordinary preservation means is extended instruction word contraction equipment according to claim 1 characterized by prefetching and updating new instruction word from the above-mentioned instruction word preservation means to coincidence, when all the instruction word saved at many buffers is processed by the instruction word selection means and the extended data analysis means.

[Claim 10] If the above-mentioned extended data analysis means has general instruction word in the buffer of the above-mentioned extraordinary preservation means If extended data are outputted to the above-mentioned extended data storage means and there is no general instruction word in the buffer of the above-mentioned extraordinary preservation means when the general instruction word concerned is outputted to the above-mentioned general instruction word analysis means from the above-mentioned instruction word selection means Extended instruction word contraction equipment according to claim 1

characterized by outputting extended data to the above-mentioned extended data storage means when the instruction word which does not carry out any operation from the above-mentioned instruction word selection means, either is outputted to the above-mentioned general instruction word analysis means.

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[Translation done.]

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the extended instruction word contraction equipment which processes extended instruction word in the central processing unit using fixed die-length instruction word at the time of execution of general instruction word about extended instruction word contraction equipment (Extended instructionfolding system).

[0002]

[Description of the Prior Art] Generally, a central processing unit (Micro-Processor) reads the program which consists of a set of the instruction word of a large number saved in memory, analyzes this with an instruction word analyzer, and performs actuation which corresponds to each instruction word with an effector.

[0003] If the magnitude of instruction word of the number of bits of the die length of instruction word, i.e., one instruction word, is various, it will be made into adjustable die-length instruction word, and if the magnitude of the number of bits of all instruction word is the same, it will be called fixed die-length instruction word.

[0004] The conventional central processing unit is divided into CISC (Complex InstructionSet Computer) and RISC (Reduced Instruction Set Computer), and, in CISC, RISC uses fixed die-length instruction word using adjustable die-length instruction word.

[0005] Although the die length is various and, as for the adjustable die-length instruction word method, has many kinds of instruction word with instruction word, since the die length of instruction word is adjustable, the instruction word analyzer which analyzes instruction word has a complicated configuration, and has the demerit in which execution speed is slow.

[0006] On the other hand, although fixed die-length instruction word with the fixed die length of all instruction word is used for a fixed die-length instruction word method, the configuration of an instruction word analyzer is simple and high-speed operation is possible, since the die length of instruction word is fixed, it has the trouble that the range of the operand which may be expressed is restricted. That is, since the die length of an operand is smaller than the magnitude of a register (Register), and the magnitude of the range of the address of preservation equipment, the address of a larger constant value than the magnitude of instruction word or preservation equipment cannot be created with one instruction word.

[0007] Though the thing for solving the above-mentioned trouble in the conventional adjustable die-length instruction word and a fixed die-length instruction word method is an extended instruction word

method and is fixed die-length instruction word with the fixed die length of all instruction word, it is the method which can be equipped with the extended data storage section and can express the instruction word of all die length.

[0008] Drawing 1 is the Fig. of an extended instruction word method of operation. As shown in drawing 1, if the operation code OP is general instruction word, according to the operation code concerned, it will perform with an effector by analyzing the operation code OP of the instruction word which used two extended instruction word in order that drawing 1 might express the address of a larger constant value than the magnitude of instruction word, or preservation equipment, and was read in preservation equipment, and if the operation code OP of the read instruction word is extended instruction word, the 1st operand OPER1 of instruction word is saved in the extended data storage section ER. If extended instruction word is the extended instruction word used after the general instruction word using the extended data saved in the extended data storage section ER for the first time at this time, among the extended data storage sections ER, from the 1st operand OPER1 of extended instruction word, a high order bit will be filled with the value of most significant bit MSB of the 1st operand OPER1 of extended instruction word, and the location of the same bit as the 1st operand OPER1 of extended instruction word will be filled with the 1st operand OPER1 of extended instruction word.

[0009] If subsequent instruction word is extended instruction word, only the number of bits of the 2nd operand OPER2 will shift the extended data which carried out data processing of the 1st operand OPER1 saved in the extended data storage section ER, and generated it to a high order bit (Shift), and the 2nd operand OPER2 will be put on the lower bit as for which the extended data storage section ER is vacant. Therefore, as for the extended data storage section ER, the 2nd operand OPER2 and the 1st operand OPER1 are located in a high order bit from the least significant bit. That is, in the extended data storage section ER, the value which the 1st operand OPER1 and the 2nd operand OPER2 combined is saved by two extended instruction word.

[0010] Therefore, the address of a larger constant value than the magnitude of instruction word or preservation equipment can be made by using extended instruction word in a fixed die-length instruction word method by the above-mentioned approach.

[0011]

[Problem(s) to be Solved by the Invention] Since the fixed die-length instruction word method using the conventional extended instruction word must read extended instruction word in preservation equipment like general instruction word, must analyze extended instruction word with an instruction word analyzer and must perform actuation of extended instruction word with an effector, it has the trouble of reducing the effectiveness of a central processing unit, and the effectiveness of a program.

[0012] In order to use for the purpose of this invention the data which are the address of a larger constant value than the magnitude of the general instruction word saved in the extended data storage section by extended instruction word, or preservation equipment By processing the extended instruction word which follows while reading and performing general instruction word The general instruction word after the extended instruction word which follows can be processed immediately, and it is in this offering the extended instruction word contraction equipment which can make the effectiveness of \*\*\*\*\*, and the effectiveness of a program maximum-ize.

[0013]

[Means for Solving the Problem]

[0014] In order to attain the above-mentioned purpose, the extended instruction word contraction equipment of this invention The extraordinary preservation section which consisted of many buffers which prefetch and save much instruction word from the instruction word preservation section; instruction word preservation section where the instruction word which consisted of much general instruction word and extended instruction word was saved; The instruction word of a large number prefetched from the instruction word preservation section to the extraordinary preservation section is received. The inside of the instruction word which decoded the received instruction word and was saved

in the extraordinary preservation section, The instruction word retrieval section which outputs the position signal which shows the location of general instruction word, and the location of one or more continuous extended instruction word; The inside of the instruction word which received the position signal which is the output of the instruction word retrieval section, and was saved by the position signal at each buffer of the extraordinary preservation section, The instruction word selection section which chooses the buffer where general instruction word was saved, and outputs general instruction word one by one; The general instruction word outputted from the instruction word selection section is received. The general instruction word analysis section which outputs many control signals for performing general instruction word; The inside of the instruction word which received the position signal which is the output of the instruction word retrieval section, and was saved at each buffer of the extraordinary preservation section, It is characterized by having the extended data storage section which receives the extended data which are the output of extended data analysis section; which receives the operand of one or more continuous extended instruction word, carries out data processing of the received operand, and outputs extended data, and the extended data analysis section, and saves this.

[0015] The instruction word retrieval section judges whether each instruction word which receives the instruction word prefetched from the instruction word preservation section to the extraordinary preservation section, and is prefetched to the extraordinary preservation section is general instruction word, or it is extended instruction word. The extended instruction retrieval section which outputs the flag signal activated when it was extended instruction word; to each instruction word which received the flag signal which is the output of the extended instruction retrieval section, and was saved at many buffers of the extraordinary preservation section [ whether it is extended instruction word and ] Receive many flag bits of flag register; which consisted of flag bits of a large number which show whether it is general instruction word, and a flag register, and the activated state of each flag bit is judged. It is characterized by having the extended decoder which outputs the position signal which shows the location of a buffer where general instruction word was saved among many buffers of the extraordinary preservation section, and the location of a buffer where one or more continuous extended instruction word was saved.

[0016]

[Embodiment of the Invention] Hereafter, with reference to the attached drawing, the extended instruction word contraction equipment of this invention is explained to a detail.

[0017] Drawing 2 is the block diagram having shown the extended instruction word contraction equipment of this invention. The extended instruction word contraction equipment of this invention of drawing 2 Much instruction word is prefetched from the instruction word preservation section 100 where the instruction word which consisted of much general instruction word and extended instruction word was saved, and the instruction word preservation section 100 (Pre-Fetch). The instruction word of a large number prefetched from the extraordinary preservation section 200 which consisted of many buffers BU1-BUn to save, and the instruction word preservation section 100 to the extraordinary preservation section 200 is received. The inside of the instruction word which decoded received instruction word (decode) and was saved in the extraordinary preservation section 200, The inside of the instruction word which received the position signal POS which is the output of the instruction word retrieval section 300 and the instruction word retrieval section 300 which outputs the position signal POS which shows the location of general instruction word, and the location of one or more continuous extended instruction word, and was saved by the position signal POS at each buffer of the extraordinary preservation section 200, The buffer where the general instruction word concerned was saved when general instruction word existed is chosen. The general instruction word outputted from the instruction word selection section 400 which outputs general instruction word one by one, and the instruction word selection section 400 is received. The inside of the instruction word which received the position signal POS which is the output of the general instruction word analysis section 700 and the instruction word retrieval section 300 which outputs many control signals for performing general instruction word, and

was saved at each buffers BU1-BUn of the extraordinary preservation section 200, The operand OPER1 of one or more [ which was saved at each buffer of the extraordinary preservation section 200 when one or more continuous extended instruction word existed ] continuous extended instruction word – OPERn are received. It consists of the extended data analysis section 500 which carries out data processing of the received operand OPER1 – OPERn, and outputs the extended data ED, and the extended data storage section 600 which receives the extended data ED which are the output of the extended data analysis section 500, and saves this.

[0018] The instruction word retrieval section 300 judges whether each instruction word which searches the instruction word prefetched from the instruction word preservation section 100 to the extraordinary preservation section 200, and is prefetched to the extraordinary preservation section 200 is general instruction word, or it is extended instruction word. Receive flag signal FLAG which is the output of the extended instruction retrieval section 310 and the extended instruction retrieval section 310 which outputs flag signal FLAG activated when it was extended instruction word, and flag signal FLAG is saved at many flag bits FB1-FBn. To each instruction word saved at many buffers BU1-BUn of the extraordinary preservation section 200 [ whether it is extended instruction word and ] Receive the output of many flag bits FB1-FBn of the flag register 320 which shows whether it is general instruction word, and a flag register 320, and the activated state of each flag bit is judged. It consists of extended decoders 330 which output the position signal POS which shows the location of a buffer where general instruction word was saved among many buffers BU1-BUn, and the location of a buffer where one or more continuous extended instruction word was saved.

[0019] The extraordinary preservation section 200 will prefetch and update new instruction word to coincidence at the instruction word preservation section 100, if all the instruction word saved at many buffers BU1-BUn is processed by the instruction word selection section 400 and the extended data analysis section 500.

[0020] In order to obtain the extended data ED according to execution of extended instruction word, the extended data analysis section 500 carries out data processing of the operand OPER1 of one or more continuous extended instruction word – the OPERn.

[0021] The extended data analysis section 500 inspects one or more [ which was saved at many buffers BU1-BUn of the extraordinary preservation section 200 ] continuous extended instruction word in order of [ BU1, BU2, —, BUn ] a location, and receives each extended instruction word. After the general instruction word [ instruction word / extended ] using the extended data ED, most with the extended instruction word of an eye If it is the extended instruction word which does not follow former extended instruction word, the operand of extended instruction word will be filled to the lower bit of the extended data ED, and it will fill with the same value as the most significant bit of the operand of extended instruction word from the number of bits of the operand of extended instruction word to the extended data ED of a high order bit. If extended instruction word is the extended instruction word which follows former extended instruction word, only the number of bits of the operand of extended instruction word will move the extended data ED generated before to the bit of a high order, and the operand of extended instruction word will be filled to a vacant lower bit.

[0022] If there is general instruction word using the extended data ED generated by the buffer of the extraordinary preservation section 200 with one or more continuous extended instruction word, when the general instruction word concerned will be outputted to the general instruction word analysis section 700 by the instruction word selection section 400, the extended data ED generated by one or more continuous extended instruction word are outputted to the extended data storage section 600. If there is no general instruction word using the extended data ED generated by the buffer of the extraordinary preservation section 200 with one or more continuous extended instruction word, when the last general instruction word will be outputted to the general instruction word analysis section 700 by the instruction word selection section 400, the extended data ED are outputted to the extended data storage section 600. General instruction word does not exist in the buffer of the extraordinary preservation section 200,



but if there is only all extended instruction word, when the instruction word which does not carry out any operation by the instruction word selection section 400, either will be outputted to the general instruction word analysis section 700, the extended data ED are outputted to the extended data storage section 600.

[0023] The extended data ED which are the output of the extended data analysis section 500 may be the data which added together the operand OPER1 of one or more continuous extended instruction word – OPERn, or data which shifted the operand OPER1 of one or more continuous extended instruction word – OPERn to right-hand side.

[0024] The actuation of the extended instruction word contraction equipment of this invention by the above-mentioned configuration is as follows. Drawing 3 is the timing chart of the extended instruction word contraction equipment of this invention of drawing 2 of operation. In the instruction word preservation section 100, one by one For example, the 1st general instruction word, the 1st escape instruction word, The instruction word for carrying out the 2nd escape instruction word, the 3rd escape instruction word, the 2nd general instruction word, and the 3rd general instruction word is saved. If it assumes that the extraordinary preservation section 200 prefetches to coincidence two instruction word which consisted of the 1st buffer BU1 and the 2nd buffer BU2, and was saved in the instruction word preservation section 100 to the 1st buffer BU1 and the 2nd buffer BU2 The timing of drawing 2 by drawing 3 of operation is as follows.

[0025] the [ first, / which are two instruction word saved in the instruction word preservation section 100 ] — 1 general instruction word and the 1st escape instruction word — t 1 hour — prefetch (PF) — carrying out — the — 1 general instruction word is saved at the 1st buffer BU1 of the extraordinary preservation section 200, and the 1st escape instruction word is saved at the 2nd buffer BU2 of the extraordinary preservation section 200 at coincidence. When the 1st general instruction word and the 1st escape instruction word are prefetched from the instruction word preservation section 100 to the extraordinary preservation section 200 in t 1 hour (PF), the extended instruction retrieval section 310 [ whether each instruction word which receives the 1st general instruction word and the 1st escape instruction word which are the instruction word which is the output of the instruction word preservation section 100, and is saved at the 1st buffer BU1 and the 2nd buffer BU2 of the extraordinary preservation section 200 is general instruction word, and ] Flag signal FLAG which shows whether it is extended instruction word is outputted. Since the instruction word which the instruction word preservation section 100 outputs is the 1st general instruction word and the 1st escape instruction word at this time, the extended instruction retrieval section 310 outputs the low logical value which is deactivated flag signal FLAG, and the high logical value which is activated flag signal FLAG. These flag signal FLAG(s) show the class of each instruction word which is saved at a flag register 320 and saved at the current buffers BU1 and BU2. In the above-mentioned example, since the 1st general instruction word is saved at the 1st buffer BU1 and the 1st escape instruction word is saved at the 2nd buffer BU2, '0' which is a low logical value is saved at the 1st flag bit FB1 of a flag register 320, and '1' which is a high logical value is saved at the 2nd flag bit FB2. The position signal POS with which the extended decoder 330 shows that the 1st escape instruction word is located in the 2nd buffer BU2 by locating the 1st general instruction word in the 1st buffer BU1 with reference to the value of the 1st flag bit FB1 of a flag register 320 and the 2nd flag bit FB2 is outputted.

[0026] The instruction word selection section 400 outputs the 1st general instruction word saved at the 1st buffer BU1 to the general instruction word analysis section 700 with the position signal POS which is the output of the extended decoder 330 in t 2 hours. Namely, the fetch of the 1st general instruction word and decoding (IF) are carried out by the general instruction word analysis section 700 in t 2 hours. The operand OPER of the 1st escape instruction word saved by the position signal POS at the 2nd buffer BU2 is outputted to the extended data analysis section 500 at the same time it carries out the fetch of the 1st general instruction word, and decoding (IF). That is, the fetch (IF) of the 1st escape instruction word is carried out by the extended data analysis section 500. The extended data analysis

section 500 carries out data processing of the operand OPER of the 1st escape instruction word, and outputs the extended data ED. Since the 1st escape instruction word is the first extended instruction word by which it comes after general instruction word, the operand OPER of the 1st escape instruction word is inputted into the lower bit of the extended data ED, and from the number of bits of the operand OPER of the inputted 1st escape instruction word, a high order bit inputs the same value as the most significant bit of the operand OPER of the inputted 1st escape instruction word, and, as for the extended data analysis section 500, generates the extended data ED. The extended data storage section 600 will output the saved extended data ED, if the extended data ED which are the output of the extended data analysis section 500 are saved and the extended data ED are required by the general instruction word using the extended data ED. The extended instruction word which follows the extended instruction word received before the instruction word with which the 1st escape instruction word was saved at the buffers BU1 and BU2 of the extraordinary preservation section 200, that is, when data processing of both the extended instruction word received before and the 1st escape instruction word received now must be carried out and the extended data ED must be updated. Only the number of bits of the operand of the 1st escape instruction word moves the extended data ED generated before to the bit of a high order, and the operand of the 1st escape instruction word is filled to a vacant lower bit.

[0027] An effector performs the 1st general instruction word concerned with the control signal of a large number by the 1st general instruction word outputted in t 3 hours from the instruction word analysis section 700 (EX). The result depended on activation of the 1st general instruction word in t 4 hours is saved at the specific register of memory or a central processing unit (ST).

[0028] By the above approaches, the 2nd escape instruction word and the 3rd escape instruction word which were saved in the instruction word preservation section 100 in t 2 hours which carries out the fetch of the 1st general instruction word and the 1st escape instruction word, and decoding (IF) It is prefetched respectively to the 1st buffer BU1 and the 2nd buffer BU2 of the extraordinary preservation section 200 (PF). The extended instruction retrieval section 310 inspects the instruction word prefetched (PF) to coincidence, and flag signal FLAG each instruction word indicates it to be whether it is extended instruction word or it is general instruction word is outputted to it. A flag register 320 outputs flag signal FLAG which saves flag signal FLAG which is the output of the extended instruction retrieval section 310, and is saved to the extended decoder 330. The extended decoder 330 outputs the position signal POS which shows that there is only extended instruction word by flag signal FLAG to each buffers BU1 and BU2 of the current emergency preservation section 200. It turns out that the instruction word selection section 400 does not have general instruction word in the extraordinary preservation section 200 by the position signal POS in t 3 hours, and the instruction word which does not carry out any operation in the general instruction word analysis section 700, either, i.e., an NOP (No Operation) instruction, is outputted. With a position signal POS, the extended data analysis section 500 receives the operand OPER of the 2nd escape instruction word saved in the extraordinary preservation section 200, and the 3rd escape instruction word, carries out data processing of these, and generates the extended data ED. Since the 2nd escape instruction word and the 3rd escape instruction word are the extended instruction word with which the 1st escape instruction word by which data processing was carried out before continued, the extended data ED generated by the 1st escape instruction word are moved to a high order bit, and the operand OPER of the 2nd escape instruction word and the 3rd escape instruction word is inputted as sequence in a seat of the lower bit as for which the extended data ED are vacant. At this time, the number of bits to which it is made to move is the same as that of the sum total of the number of bits of the operand OPER of the 2nd escape instruction word and the 3rd escape instruction word. In the extended data storage section 600, the extended data ED generated by the 1st escape instruction word, the 2nd escape instruction word, and the 3rd escape instruction word which are the output of the extended data analysis section 500 are saved. Therefore, the fetch of the 2nd escape instruction word and the 3rd escape instruction word and decoding (IF) are carried out in t 3 hours.

[0029] Like the above the 2nd general instruction word and the 3rd general instruction word which were saved in the instruction word preservation section 100 in t 3 hours It is prefetched respectively to the 1st buffer BU1 and the 2nd buffer BU2 of the extraordinary preservation section 200 (PF). The extended instruction retrieval section 310 outputs flag signal FLAG which shows that all the instruction word prefetched (Pre-Fetch) is general instruction word. A flag register 320 outputs flag signal FLAG which saved flag signal FLAG which is the output of the extended instruction retrieval section 310, and was saved to the extended decoder 330. All the instruction word saved in the current emergency preservation section 200 is general instruction word, and the extended decoder 330 outputs the position signal POS which shows that extended instruction word is not saved. It turns out that all the instruction word that received the position signal POS of the extended decoder 330, and was saved in the extraordinary preservation section 200 is general instruction word, and the instruction word selection section 400 outputs the 2nd general instruction word and the 3rd general instruction word which were saved at the 1st buffer BU1 and the 2nd buffer BU2 to the instruction word analysis section 700 one by one. With a position signal POS, it turns out that there is no extended instruction word among the instruction word saved in the extraordinary preservation section 200, and the extended instruction word analysis section 500 does not update the extended data ED. Activation (EX) and preservation (ST) of the henceforth are the same. When the 2nd general instruction word or the 3rd general instruction word is the instruction using the extended data ED, an effector performs general instruction word applicable to this using the extended data ED already saved in the extended data storage section 600.

[0030] Therefore, since four pipeline (Pipe Line) clocks are required for the extended instruction word contraction equipment of this invention as shown in the timing chart of operation by drawing 3 and two pipeline clocks are reduced compared with the former, the effectiveness of a central processing unit and the effectiveness of a program can be increased.

[0031] Drawing 4 is other timing charts of the extended instruction word contraction equipment of this invention of drawing 2 of operation. it is shown in drawing 4 — as — the instruction word preservation section 100 — one by one — the — the [ 1 general instruction word, the 1st escape instruction word, the 2nd escape instruction word, and ] — 2 general instruction word is saved, the extraordinary preservation section 200 consists of four buffers BU1-BU4, and when the flag register 320 consists of 4-bit flag bits FB1-FB4, the actuation of the extended instruction word contraction equipment of this invention of drawing 2 is as follows.

[0032] The 1st general instruction word saved in the instruction word preservation section 100 four in four buffer [ of the extraordinary preservation section 200 ] BU1 – BU4, the 1st escape instruction word, the 2nd escape instruction word, and the 2nd general instruction word are prefetched (PF). To coincidence, the extended instruction retrieval section 310 searches the instruction word outputted from the instruction word preservation section 100, judges to it which instruction word is general instruction word among instruction word, or whether it is extended instruction word; the signal FLAG activated when it was extended instruction word is outputted, and if it is general instruction word, deactivated flag signal FLAG will be outputted. A flag register 320 saves flag signal FLAG which is the output of the extended instruction retrieval section 310 at many flag bits FB1-FB4. In the case of the above-mentioned example, the top flag bit FB4 has data of '0110' from the lowest flag bit FB1, and a flag register 320 outputs the position signal POS which shows whether the instruction word which the extended decoder 330 judged the activated state of each flag bits FB1-FB4 of a flag register 320, and was saved at each buffers BU1-BU4 of the extraordinary preservation section 200 is general instruction word, or it is extended instruction word. Therefore, it is turned out whether the extended instruction word or general instruction word which is each instruction word is saved by the extended decoder 330 at the buffer located in what position of the extraordinary preservation section 200.

[0033] The inside of the instruction word with which the instruction word selection section 400 was saved by the position signal POS which is the output of the extended decoder 330 at each buffers BU1-BU4 of the extraordinary preservation section 200 in t 2 hours, Outputting the 1st general instruction

word which chose the 1st buffer BU1 where the general instruction word of an eye was saved most, and was saved at the 1st buffer BU1 to the general instruction word analysis section 700, the general instruction word analysis section 700 analyzes the 1st general instruction word, and outputs many control signals. That is, the fetch of the 1st general instruction word and decoding (IF) which were saved by the instruction word selection section 400 and the general instruction word analysis section 700 in the extraordinary preservation section 200 in t 2 hours are carried out. t 3 hours — many control signals — an effector — the [ concerned ] — 1 general instruction word — activation (EX) — carrying out — t 4 hours — the — the result depended on activation of 1 general instruction word is saved at the specific register of memory or a central processing unit (ST).

[0034] With a position signal POS, the extended data analysis section 500 receives each operand OPER2 and OPER3 of the 1st escape instruction word saved at the 2nd buffer BU2 and the 3rd buffer BU3, and the 2nd escape instruction word, carries out data processing of the received operands OPER2 and OPER3 in t 2 hours which carries out the fetch of the 1st general instruction word, and decoding (IF), and outputs the extended data ED to them. When carrying out data processing of the operands OPER2 and OPER3 and generating the extended data ED When it is the operand OPER2 of the extended instruction word which should be carried out for the first time after the 1st escape instruction word is the 1st general instruction word, The operand OPER3 of the 2nd escape instruction word and the operand OPER2 of the 1st escape instruction word are filled from the least significant bit of the extended data ED as sequence. From the most significant bit of the operand OPER2 of the 1st escape instruction word, the bit of the extended data ED of a high order is filled with the same bit as the most significant bit of the operand OPER2 of the 1st escape instruction word, and generates the extended data ED. When extended instruction word is continuously used with former extended instruction word, only the number of bits of the operands OPER2 and OPER3 of the 1st and 2nd escape instruction word is moved to a high order, and the extended data ED generated with front instruction word are filled with the operands OPER2 and OPER3 of the 1st and 2nd escape instruction word one by one to a vacant lower bit.

[0035] The extended data storage section 600 receives the extended data ED of the extended data analysis section 500, and saves this.

[0036] By the above approaches, the instruction word selection section 400 The 2nd general instruction word saved by the position signal POS at the 4th buffer BU4 of the extraordinary preservation section 200 is chosen. The common instruction analysis section 700 The fetch of the 2nd general instruction word and decoding (IF) are carried out in t 3 hours. the control signal of a large number outputted from the common instruction analysis section 700 — t 4 hours — an effector — the — 2 general instruction word — activation (EX) — carrying out — t 5 hours — the — the result depended on activation of 2 general instruction word is saved at the specific register of memory or a central processing unit (ST).

[0037] If the 2nd general instruction word is the instruction word using the extended data ED, as for an effector, the 2nd general instruction word will be performed in t 4 hours using the extended data ED already saved in the extended data storage section 600.

[0038]

[Effect of the Invention] By processing the extended instruction word which follows while reading and performing general instruction word, the extended instruction word contraction equipment of this invention can process immediately the general instruction word after the extended instruction word which follows, and can increase the engine performance of the central processing unit of an extended instruction word method.

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[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The Fig. of extended instruction word of operation.

[Drawing 2] The block diagram showing the extended instruction word contraction equipment of this invention.

[Drawing 3] The timing chart of the extended instruction word contraction equipment of this invention of drawing 2 of operation.

[Drawing 4] Other timing charts of the extended instruction word contraction equipment of this invention of drawing 2 of operation.

[Description of Notations]

100 — Instruction word preservation section

200 — Extraordinary preservation section

300 — Instruction word retrieval section

310 — Extended instruction retrieval section

320 — Flag register

330 — Extended decoder

400 — Instruction word selection section

500 — Extended data analysis section

600 — Extended data storage section

700 — General instruction word analysis section

POS — Position signal

BU1-BUn — Buffer

ED — Extended data

FLAG — Flag signal

FB1-FBn — Flag bit

OPER1 - OPERn — Operand

PF — Prefetch

IF — Decoding

EX — Activation

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[Translation done.]



(2)

## 【特許請求の範囲】

【請求項1】命令語の大きさより大きい定数値や保存装置のアドレスであるデータを用いるための拡張命令語を遂行する中央処理装置において、多数の一般命令語及び拡張命令語から構成された命令語が保存された命令語保存手段と、

上記命令語保存手段から多数の命令語をプリフェッチして保存する多数個のバッファから構成された臨時保存手段と、

上記命令語保存手段から上記臨時保存手段へプリフェッチされる多数の命令語を受信し、受信された命令語をデコードして上記臨時保存手段に保存された命令語のうち、一般命令語の位置と1以上の連続した拡張命令語の位置とを示す位置信号を出力する命令語検索手段と、上記命令語検索手段の出力である位置信号を受信して位置信号によって上記臨時保存手段の各バッファに保存された命令語のうち、一般命令語が保存されたバッファを選択して一般命令語を順次に出力する命令語選択手段と、

上記命令語選択手段から出力される一般命令語を受信して一般命令語を実行するための多数の制御信号を出力する一般命令語解析手段と、

上記命令語検索手段の出力である位置信号を受信して上記臨時保存手段の各バッファに保存された命令語のうち、1以上の連続した拡張命令語の被演算子を受信し、受信された被演算子の演算処理を遂行して拡張データを出力する拡張データ解析手段と、

上記拡張データ解析手段の出力である拡張データを受信してこれを保存する拡張データ保存手段と、を備えたことを特徴とする拡張命令語縮約装置。

【請求項2】上記命令語検索手段は、

前記命令語保存手段から上記臨時保存手段へプリフェッチされる命令語を受信し、上記臨時保存手段へプリフェッチされる各命令語が一般命令語であるか、拡張命令語であるかを判断してフラグ信号を出力する拡張命令検索手段と、

上記拡張命令検索手段の出力であるフラグ信号を受信し、上記臨時保存手段の多数のバッファに保存されたそれぞれの命令語に対して、拡張命令語であるか、一般命令語であるかを示す多数のフラグビットから構成されたフラグレジスタと、

上記フラグレジスタの多数のフラグビットを判断して上記臨時保存手段の多数のバッファのうち、一般命令語が保存されたバッファの位置、及び少なくとも1以上の連続した拡張命令語が保存されたバッファの位置を示す位置信号を出力する拡張デコーダと、

を備えたことを特徴とする請求項1に記載の拡張命令語縮約装置。

【請求項3】上記拡張データ解析手段は、上記臨時保存手段の多数のバッファに保存された1以上の連続した

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拡張命令語を出現順序の順に検査し、それぞれの拡張命令語に対して、拡張命令語が拡張データを用いる一般命令語の以後の一番目の拡張命令語であって、以前の拡張命令語によって連続する拡張命令語であれば、拡張データの下位ビットには拡張命令語の被演算子を満たし、拡張命令語の被演算子のビット数より上位ビットの拡張データには拡張命令語の被演算子の最上位ビットと同一の値で満たして、拡張命令語が以前の拡張命令語によって連続する拡張命令語であれば、以前に生成された拡張データを拡張命令語の被演算子のビット数だけ上位のビットに移動させ、空いている下位ビットに拡張命令語の被演算子を満たすことを特徴とする請求項1に記載の拡張命令語縮約装置。

【請求項4】上記拡張データ解析手段は、上記臨時保存手段の多数のバッファに保存された1以上の連続した拡張命令語を出現順序の順に検査し、それぞれの拡張命令語に対して、拡張データを拡張命令語の被演算子のビット数だけ上位のビットに移動させ、空いている下位ビットに拡張命令語の被演算子を満たすことを特徴とする請求項1に記載の拡張命令語縮約装置。

【請求項5】上記拡張データ解析手段の出力である拡張データは、1以上の連続する拡張命令語の被演算子を合算したデータであることを特徴とする請求項1に記載の拡張命令語縮約装置。

【請求項6】上記拡張データ解析手段の出力である拡張データは、1以上の連続する拡張命令語の被演算子を右側へシフトさせたデータであることを特徴とする請求項1に記載の拡張命令語縮約装置。

【請求項7】上記拡張データ解析手段は、上記命令語検索手段の出力である位置信号を受信して上記臨時保存手段から上記命令語選択手段へ一般命令語が出力される時に、上記臨時保存手段の各バッファに保存された命令語のうち、1以上の連続した拡張命令語が保存されたバッファから、当該バッファに保存された拡張命令語の被演算子を受信して被演算子の演算処理を遂行することを特徴とする請求項1に記載の拡張命令語縮約装置。

【請求項8】上記命令語選択手段は、上記臨時保存手段の各バッファに保存された命令語のうち、一般命令語がなければ何らの演算も遂行しない命令語を上記一般命令語解析手段へ出力することを特徴とする請求項1に記載の拡張命令語縮約装置。

【請求項9】上記臨時保存手段は、多数のバッファに保存された全ての命令語が命令語選択手段及び拡張データ解析手段によって処理されると、同時に上記命令語保存手段から新たな命令語をプリフェッチして更新することを特徴とする請求項1に記載の拡張命令語縮約装置。

【請求項10】上記拡張データ解析手段は、上記臨時保存手段のバッファに一般命令語があれば、当該一般命令語が上記命令語選択手段から上記一般命令語解析手段へ出力される時に、拡張データを上記拡張データ保存手



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段へ出力し、上記臨時保存手段のバッファに一般命令語がなければ、上記命令語選択手段から何らの演算も遂行しない命令語が上記一般命令語解析手段へ出力される時に、拡張データを上記拡張データ保存手段へ出力することを特徴とする請求項1に記載の拡張命令語縮約装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、拡張命令語縮約装置 (Extended instruction folding system) に関し、特に固定長さ命令語を用いる中央処理装置において一般命令語の遂行時に拡張命令語を処理する拡張命令語縮約装置に関する。

【0002】

【従来の技術】一般的に、中央処理装置 (Micro-Processor) はメモリに保存された多数の命令語の集合からなっているプログラムを読み取りこれを命令語解析器によって解析し、実行器によって各命令語に該当する動作を実行する。

【0003】命令語は命令語の長さにより、即ち、一つの命令語のビット数の大きさが多様であれば可変長さ命令語とし、全ての命令語のビット数の大きさが同一であれば固定長さ命令語という。

【0004】従来の中央処理装置は、CISC (Complex Instruction Set Computer) とRISC (Reduced Instruction Set Computer) に分けられており、CISCは可変長さ命令語を用い、RISCは固定長さ命令語を用いる。

【0005】可変長さ命令語方式は、命令語によってその長さが多様で、多くの種類の命令語を有しているが、命令語の長さが可変であるので、命令語を解析する命令語解析器は複雑な構成を有し、実行速度が遅いという短所を有している。

【0006】他方、固定長さ命令語方式は、全ての命令語の長さが一定である固定長さ命令語を使用するもので、命令語解析器の構成は単純で、高速動作が可能であるが、命令語の長さが固定されるので、表現され得る被演算子の範囲が制限されるという問題点を有する。即ち、被演算子の長さはレジスタ (Register) の大きさや保存装置のアドレスの範囲の大きさより小さいために、命令語の大きさより大きい定数値や保存装置のアドレスは一つの命令語で作成することができない。

【0007】従来の可変長さ命令語と固定長さ命令語方式における上記の問題点を解決するためのものが拡張命令語方式であって、全ての命令語の長さが一定である固定長さ命令語でありながら、拡張データ保存部を備えて全ての長さの命令語を表現することができる方式である。

【0008】図1は拡張命令語方式の動作図である。図

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1に示すように、図1は命令語の大きさより大きい定数値や保存装置のアドレスを表現するために2つの拡張命令語を使用したものであり、保存装置から読み取った命令語の演算コードOPを解析して、その演算コードOPが一般命令語であれば、当該演算コードに応じて実行器によって実行され、読み取った命令語の演算コードOPが拡張命令語であれば、命令語の第1被演算子OPER1を拡張データ保存部ERに保存する。この時、拡張命令語が、拡張データ保存部ERに保存された拡張データを用いる一般命令語の以後に初めて用いられる拡張命令語であれば、拡張データ保存部ERのうち、拡張命令語の第1被演算子OPER1より上位ビットは拡張命令語の第1被演算子OPER1の最上位ビットMSBの値で満たし、拡張命令語の第1被演算子OPER1と同一のビットの位置は拡張命令語の第1被演算子OPER1で満たす。

【0009】その後の命令語が拡張命令語であれば、拡張データ保存部ERに保存された第1被演算子OPER1を演算処理して生成した拡張データを第2被演算子OPER2のビット数だけ上位ビットにシフト (Shift) させ、第2被演算子OPER2を拡張データ保存部ERの空いている下位ビットに置く。従って、拡張データ保存部ERは最下位ビットから上位ビットに第2被演算子OPER2と第1被演算子OPER1とが位置する。即ち、2つの拡張命令語によって拡張データ保存部ERには第1被演算子OPER1と第2被演算子OPER2とが結合した値が保存される。

【0010】従って、上記の方法によって固定長さ命令語方式において拡張命令語を用いることによって、命令語の大きさより大きい定数値や保存装置のアドレスを作ることができる。

【0011】

【発明が解決しようとする課題】従来の拡張命令語を用いる固定長さ命令語方式は拡張命令語を一般命令語と同様に保存装置から読み取り、命令語解析器によって拡張命令語を解析し、実行器によって拡張命令語の動作を実行しなければならないので、中央処理装置の効率及びプログラムの効率を低下させる問題点がある。

【0012】本発明の目的は、拡張命令語によって拡張データ保存部に保存された一般命令語の大きさより大きい定数値や保存装置のアドレスであるデータを用いるために、一般命令語を読み取り、実行する間後続する拡張命令語を処理することによって、後続する拡張命令語の後の一般命令語を直ちに処理することができ、これにより、中央処理装置の効率及びプログラムの効率を極大化させることができる拡張命令語縮約装置を提供することにある。

【0013】

【課題を解決するための手段】

【0014】上記の目的を達成するために、本発明の拡張

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張命令語縮約装置は、多数の一般命令語及び拡張命令語から構成された命令語が保存された命令語保存部；命令語保存部から多数の命令語をプリフェッチして保存する多数個のバッファから構成された臨時保存部；命令語保存部から臨時保存部へプリフェッチされる多数の命令語を受信し、受信された命令語をデコードして臨時保存部に保存された命令語のうち、一般命令語の位置と1以上の連続した拡張命令語の位置とを示す位置信号を出力する命令語検索部；命令語検索部の出力である位置信号を受信して位置信号によって臨時保存部の各バッファに保存された命令語のうち、一般命令語が保存されたバッファを選択して一般命令語を順次に出力する命令語選択部；命令語選択部から出力される一般命令語を受信して一般命令語を実行するための多数の制御信号を出力する一般命令語解析部；命令語検索部の出力である位置信号を受信して臨時保存部の各バッファに保存された命令語のうち、1以上の連続した拡張命令語の被演算子を受信し、受信された被演算子の演算処理を遂行して拡張データを出力する拡張データ解析部；及び拡張データ解析部の出力である拡張データを受信してこれを保存する拡張データ保存部を備えたことを特徴とする。

【0015】命令語検索部は、命令語保存部から臨時保存部へプリフェッチされる命令語を受信して臨時保存部へプリフェッチされる各命令語が一般命令語であるか、拡張命令語であるかを判断して、拡張命令語であれば活性化されたフラグ信号を出力する拡張命令検索部；拡張命令検索部の出力であるフラグ信号を受信して臨時保存部の多数のバッファに保存されたそれぞれの命令語に対して拡張命令語であるか、一般命令語であるかを示す多数のフラグビットから構成されたフラグレジスタ；及びフラグレジスタの多数のフラグビットを受信して各フラグビットの活性化状態を判断して、臨時保存部の多数のバッファのうち、一般命令語が保存されたバッファの位置、及び1以上の連続した拡張命令語が保存されたバッファの位置を示す位置信号を出力する拡張デコーダーを備えたことを特徴とする。

【0016】

【発明の実施の形態】以下、添付した図面を参照して本発明の拡張命令語縮約装置を詳細に説明する。

【0017】図2は本発明の拡張命令語縮約装置を示したブロック図である。図2の本発明の拡張命令語縮約装置は、多数の一般命令語及び拡張命令語から構成された命令語が保存された命令語保存部100、命令語保存部100から多数の命令語をプリフェッチ（Pre-Fetch）して保存する多数個のバッファBU1～BU<sub>n</sub>から構成された臨時保存部200、命令語保存部100から臨時保存部200へプリフェッチされる多数の命令語を受信し、受信された命令語をデコード（decode）して臨時保存部200に保存された命令語のうち、一般命令語の位置と1以上の連続した拡張命令語の

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位置とを示す位置信号POSを出力する命令語検索部300、命令語検索部300の出力である位置信号POSを受信して位置信号POSによって臨時保存部200の各バッファに保存された命令語のうち、一般命令語が存在すれば当該一般命令語が保存されたバッファを選択して一般命令語を順次に出力する命令語選択部400、命令語選択部400から出力される一般命令語を受信して一般命令語を実行するための多数の制御信号を出力する一般命令語解析部700、命令語検索部300の出力である位置信号POSを受信して臨時保存部200の各バッファBU1～BU<sub>n</sub>に保存された命令語のうち、1以上の連続した拡張命令語が存在すれば臨時保存部200の各バッファに保存された1以上の連続した拡張命令語の被演算子OPER1～OPER<sub>n</sub>を受信し、受信された被演算子OPER1～OPER<sub>n</sub>の演算処理を遂行して拡張データEDを出力する拡張データ解析部500、及び拡張データ解析部500の出力である拡張データEDを受信してこれを保存する拡張データ保存部600から構成される。

【0018】命令語検索部300は、命令語保存部100から臨時保存部200へプリフェッチされる命令語を検索して臨時保存部200へプリフェッチされる各命令語が一般命令語であるか、拡張命令語であるかを判断して、拡張命令語であれば活性化されたフラグ信号FLAGを出力する拡張命令検索部310、拡張命令検索部310の出力であるフラグ信号FLAGを受信して多数のフラグビットFB1～FB<sub>n</sub>にフラグ信号FLAGを保存し、臨時保存部200の多数のバッファBU1～BU<sub>n</sub>に保存されたそれぞれの命令語に対して拡張命令語であるか、一般命令語であるかを示すフラグレジスタ320、及びフラグレジスタ320の多数のフラグビットFB1～FB<sub>n</sub>の出力を受信して各フラグビットの活性化状態を判断し、多数のバッファBU1～BU<sub>n</sub>のうち、一般命令語が保存されたバッファの位置、及び1以上の連続した拡張命令語が保存されたバッファの位置を示す位置信号POSを出力する拡張デコーダー330から構成される。

【0019】臨時保存部200は、多数のバッファBU1～BU<sub>n</sub>に保存された全ての命令語が命令語選択部400及び拡張データ解析部500によって処理されると、同時に新たな命令語を命令語保存部100にプリフェッチして更新する。

【0020】拡張命令語の遂行に従う拡張データEDを得るために、拡張データ解析部500は1以上の連続する拡張命令語の被演算子OPER1～OPER<sub>n</sub>を演算処理する。

【0021】拡張データ解析部500は、臨時保存部200の多数のバッファBU1～BU<sub>n</sub>に保存された1以上の連続した拡張命令語を位置順BU1、BU2、…、BU<sub>n</sub>に検査し、それぞれの拡張命令語に対して、

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拡張命令語が拡張データEDを用いる一般命令語の以後の一番目の拡張命令語で、以前の拡張命令語と連続しない拡張命令語であれば、拡張データEDの下位ビットには拡張命令語の被演算子を満たし、拡張命令語の被演算子のビット数より上位ビットの拡張データEDには拡張命令語の被演算子の最上位ビットと同一の値で満たす。若し、拡張命令語が以前の拡張命令語と連続する拡張命令語であれば、以前に生成された拡張データEDを拡張命令語の被演算子のビット数だけ上位のビットに移動させ、空いている下位ビットに拡張命令語の被演算子を満たす。

【0022】臨時保存部200のバッファに1以上の連続した拡張命令語によって生成された拡張データEDを用いる一般命令語があれば、当該一般命令語が命令語選択部400によって一般命令語解析部700へ出力される時に、1以上の連続した拡張命令語によって生成された拡張データEDを拡張データ保存部600へ出力する。臨時保存部200のバッファに1以上の連続した拡張命令語によって生成された拡張データEDを用いる一般命令語がなければ、最後の一般命令語が命令語選択部400によって一般命令語解析部700へ出力される時に、拡張データEDを拡張データ保存部600へ出力する。臨時保存部200のバッファに一般命令語は存在せず、全て拡張命令語だけがあれば命令語選択部400によって何らの演算も遂行しない命令語が一般命令語解析部700へ出力される時に、拡張データEDを拡張データ保存部600へ出力する。

【0023】拡張データ解析部500の出力である拡張データEDは1以上の連続する拡張命令語の被演算子OPER1～OPERnを合算したデータ、または1以上の連続する拡張命令語の被演算子OPER1～OPERnを右側へシフトさせたデータであってもよい。

【0024】上記の構成による本発明の拡張命令語縮約装置の動作は以下の通りである。図3は、図2の本発明の拡張命令語縮約装置の動作タイミング図である。例えば、命令語保存部100には、順次に、第1一般命令語、第1拡張命令語、第2拡張命令語、第3拡張命令語、第2一般命令語及び第3一般命令語を遂行するための命令語が保存されており、臨時保存部200は第1バッファBU1と第2バッファBU2とから構成され、命令語保存部100に保存された2つの命令語を同時に第1バッファBU1と第2バッファBU2へプリフェッチすると仮定すると、図3による図2の動作タイミングは以下の通りである。

【0025】先ず、命令語保存部100に保存された2つの命令語である第1一般命令語及び第1拡張命令語を、t1時間にプリフェッチ(PF)して第1一般命令語は臨時保存部200の第1バッファBU1に保存され、同時に、第1拡張命令語は臨時保存部200の第2バッファBU2に保存される。拡張命令検索部310は、

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t1時間に命令語保存部100から臨時保存部200へ第1一般命令語及び第1拡張命令語がプリフェッチ(PF)される時に、命令語保存部100の出力である命令語である第1一般命令語及び第1拡張命令語を受信して臨時保存部200の第1バッファBU1及び第2バッファBU2に保存されるそれぞれの命令語が一般命令語であるか、拡張命令語であるかを示すフラグ信号FLAGを出力する。この時、命令語保存部100が出力する命令語は第1一般命令語と第1拡張命令語であるので、拡張命令検索部310は非活性化されたフラグ信号FLAGであるロー論理値と活性化されたフラグ信号FLAGであるハイ論理値を出力する。これらのフラグ信号FLAGはフラグレジスタ320に保存されて現在バッファBU1、BU2に保存されている各命令語の種類を示す。上記の例において、第1一般命令語は第1バッファBU1に保存され、第1拡張命令語は第2バッファBU2に保存されるので、フラグレジスタ320の第1フラグビットFB1にはロー論理値である‘0’が保存され、第2フラグビットFB2にはハイ論理値である‘1’が保存される。拡張デコーダー330はフラグレジスタ320の第1フラグビットFB1と第2フラグビットFB2の値を参照して、第1一般命令語は第1バッファBU1に位置し、第1拡張命令語は第2バッファBU2に位置していることを示す位置信号POSを出力する。

【0026】t2時間に拡張デコーダー330の出力である位置信号POSによって命令語選択部400は第1バッファBU1に保存された第1一般命令語を一般命令語解析部700へ出力する。即ち、t2時間に一般命令語解析部700によって第1一般命令語のフェッチ及びデコード(IF)を遂行する。第1一般命令語のフェッチ及びデコード(IF)を遂行すると同時に、位置信号POSによって第2バッファBU2に保存された第1拡張命令語の被演算子OPERを拡張データ解析部500へ出力する。即ち、拡張データ解析部500によって第1拡張命令語をフェッチ(IF)する。拡張データ解析部500は第1拡張命令語の被演算子OPERを演算処理して拡張データEDを出力する。拡張データ解析部500は第1拡張命令語が一般命令語の後にくる一番目の拡張命令語であるので、拡張データEDの下位ビットには第1拡張命令語の被演算子OPERを入力し、入力された第1拡張命令語の被演算子OPERのビット数より上位ビットは、入力された第1拡張命令語の被演算子OPERの最上位ビットと同一の値を入力して拡張データEDを生成する。拡張データ保存部600は拡張データ解析部500の出力である拡張データEDを保存し、拡張データEDを用いる一般命令語によって拡張データEDが要求されると、保存していた拡張データEDを出力する。若し、第1拡張命令語が臨時保存部200のバッファBU1、BU2に保存された命令語の以前

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に受信された拡張命令語と連続する拡張命令語、つまり、以前に受信された拡張命令語と現在受信された第1拡張命令語とを共に演算処理して拡張データEDを更新しなければならない場合には、以前に生成された拡張データEDを第1拡張命令語の被演算子のビット数だけ上位のビットに移動させ、空いている下位ビットに第1拡張命令語の被演算子を満たす。

【0027】t3時間に命令語解析部700から出力される第1一般命令語による多数の制御信号によって実行器は当該第1一般命令語を実行(EX)する。t4時間に第1一般命令語の実行による結果をメモリまたは中央処理装置の特定のレジスタに保存(ST)する。

【0028】上記のような方法によって、命令語保存部100に保存された第2拡張命令語及び第3拡張命令語は第1一般命令語及び第1拡張命令語のフェッチ及びデコード(IF)を遂行するt2時間に、各々臨時保存部200の第1バッファBU1及び第2バッファBU2へプリフェッチ(PF)され、同時に、拡張命令検索部310はプリフェッチ(PF)される命令語を検査して各命令語が拡張命令語であるか、一般命令語であるかを示すフラグ信号FLAGを出力する。フラグレジスタ320は拡張命令検索部310の出力であるフラグ信号FLAGを保存し、拡張デコーダー330へ保存しているフラグ信号FLAGを出力する。拡張デコーダー330はフラグ信号FLAGによって現在臨時保存部200の各バッファBU1、BU2には拡張命令語だけがあることを示す位置信号POSを出力する。t3時間に命令語選択部400は位置信号POSによって臨時保存部200に一般命令語がないことが分かり、一般命令語解析部700に何らの演算も遂行しない命令語、つまり、NOP(No Operation)命令を出力する。拡張データ解析部500は位置信号POSによって臨時保存部200に保存された第2拡張命令語及び第3拡張命令語の被演算子OPERを受信してこれらを演算処理し、拡張データEDを生成する。第2拡張命令語及び第3拡張命令語は以前に演算処理された第1拡張命令語の連続した拡張命令語であるので、第1拡張命令語によって生成された拡張データEDを上位ビットに移動させ、拡張データEDの空いている下位ビットの席に第2拡張命令語及び第3拡張命令語の被演算子OPERを順序の通りに入力する。この時、移動させるビット数は第2拡張命令語及び第3拡張命令語の被演算子OPERのビット数の合計と同一である。拡張データ保存部600には拡張データ解析部500の出力である第1拡張命令語、第2拡張命令語及び第3拡張命令語によって生成される拡張データEDが保存される。従って、t3時間に第2拡張命令語及び第3拡張命令語のフェッチ及びデコード(IF)が遂行される。

【0029】上記と同様に、命令語保存部100に保存された第2一般命令語及び第3一般命令語はt3時間

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に、各々臨時保存部200の第1バッファBU1と第2バッファBU2へプリフェッチ(PF)され、拡張命令検索部310はプリフェッチ(Pre-Fetch)されている命令語が全て一般命令語であることを示すフラグ信号FLAGを出力し、フラグレジスタ320は拡張命令検索部310の出力であるフラグ信号FLAGを保存し、拡張デコーダー330へ保存されたフラグ信号FLAGを出力する。拡張デコーダー330は現在臨時保存部200に保存された命令語が全て一般命令語であり、拡張命令語が保存されていないことを示す位置信号POSを出力する。命令語選択部400は拡張デコーダー330の位置信号POSを受信して臨時保存部200に保存された命令語が全て一般命令語であることが分かり、第1バッファBU1及び第2バッファBU2に保存された第2一般命令語と第3一般命令語を順次に命令語解析部700へ出力する。拡張命令語解析部500は位置信号POSによって臨時保存部200に保存された命令語のうち、拡張命令語がないことが分かり、拡張データEDを更新しない。その以後の実行(EX)及び保存(ST)は同様である。若し、第2一般命令語または第3一般命令語が拡張データEDを用いる命令である場合、既に拡張データ保存部600に保存された拡張データEDを用いて実行器はこれに該当する一般命令語を実行する。

【0030】従って、図3による動作タイミング図に示すように、本発明の拡張命令語節約装置は4つのパイプライン(Pipeline)クロックが必要であるので、従来と比べて2個のパイプラインクロックが節減されるので、中央処理装置の効率及びプログラムの効率を増大させることができる。

【0031】図4は、図2の本発明の拡張命令語節約装置の他の動作タイミング図である。図4に示すように、命令語保存部100には、順次に、第1一般命令語、第1拡張命令語、第2拡張命令語、第2一般命令語が保存されており、臨時保存部200は4つのバッファBU1~BU4から構成され、フラグレジスタ320は4ビットのフラグビットFB1~FB4から構成されている場合、図2の本発明の拡張命令語節約装置の動作は以下の通りである。

【0032】臨時保存部200の4つのバッファBU1~BU4へt1時間に命令語保存部100に保存された第1一般命令語、第1拡張命令語、第2拡張命令語及び第2一般命令語はプリフェッチ(PF)される。同時に、拡張命令検索部310は命令語保存部100から出力される命令語を検査して命令語のうち、どの命令語が一般命令語であるか、拡張命令語であるかを判断して、拡張命令語であれば、活性化された信号FLAGを出力し、一般命令語であれば、非活性化されたフラグ信号FLAGを出力する。フラグレジスタ320は拡張命令検索部310の出力であるフラグ信号FLAGを多数のフ

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ラグビットFB1～FB4に保存する。フラグレジスタ320は、上記の実施例の場合、最下位ラグビットFB1から最上位ラグビットFB4は‘0110’のデータを有し、拡張デコーダ330は、フラグレジスタ320の各ラグビットFB1～FB4の活性化状態を判断して臨時保存部200の各バッファBU1～BU4に保存された命令語が一般命令語であるか、拡張命令語であるかを示す位置信号POSを出力する。従って、拡張デコーダ330によってそれぞれの命令語である拡張命令語または一般命令語が臨時保存部200の何番目に位置したバッファに保存されているかが分かる。

【0033】命令語選択部400は、t2時間に拡張デコーダ330の出力である位置信号POSによって臨時保存部200の各バッファBU1～BU4に保存された命令語のうち、一番目の一般命令語が保存された第1バッファBU1を選択して第1バッファBU1に保存された第1一般命令語を一般命令語解析部700へ出力し、一般命令語解析部700は、第1一般命令語を解析して多数の制御信号を出力する。即ち、t2時間に命令語選択部400及び一般命令語解析部700によって臨時保存部200に保存された第1一般命令語のフェッチ及びデコード(IF)を遂行する。t3時間に多数の制御信号によって実行器は当該第1一般命令語を実行(EX)し、t4時間に第1一般命令語の実行による結果をメモリまたは中央処理装置の特定のレジスタに保存(ST)する。

【0034】第1一般命令語のフェッチ及びデコード(IF)を遂行するt2時間に、拡張データ解析部500は位置信号POSによって第2バッファBU2と第3バッファBU3に保存された第1拡張命令語及び第2拡張命令語のそれぞれの被演算子OPER2、OPER3を受信し、受信された被演算子OPER2、OPER3を演算処理して拡張データEDを出力する。被演算子OPER2、OPER3を演算処理して拡張データEDを生成する時に、若し、第1拡張命令語が第1一般命令語の以後に初めて遂行されるべき拡張命令語の被演算子OPER2である場合、拡張データEDの最下位ビットから第2拡張命令語の被演算子OPER3及び第1拡張命令語の被演算子OPER2を順序の通りに満たし、第1拡張命令語の被演算子OPER2の最上位ビットより上位の拡張データEDのビットは第1拡張命令語の被演算子OPER2の最上位ビットと同一のビットで満たして拡張データEDを生成する。若し、拡張命令語が以前の拡張命令語と連続して用いられる場合、前の命令語で生成した拡張データEDを第1、第2拡張命令語の被演算子OPER2、OPER3のビット数だけ上位へ移動させ、空いている下位ビットに第1、第2拡張命令語の被演算子OPER2、OPER3で順次に満たす。

【0035】拡張データ保存部600は拡張データ解析

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部500の拡張データEDを受信してこれを保存する。

【0036】上記のような方法によって、命令語選択部400は、位置信号POSによって臨時保存部200の第4バッファBU4に保存された第2一般命令語を選択し、一般命令語解析部700は、t3時間に第2一般命令語のフェッチ及びデコード(IF)を遂行し、一般命令語解析部700から出力される多数の制御信号によってt4時間に実行器によって第2一般命令語を実行(EX)し、t5時間に第2一般命令語の実行による結果をメモリまたは中央処理装置の特定のレジスタに保存(ST)する。

【0037】若し、第2一般命令語が拡張データEDを用いる命令語であれば、既に拡張データ保存部600に保存された拡張データEDを用いてt4時間に実行器は第2一般命令語を実行する。

【0038】

【発明の効果】本発明の拡張命令語縮約装置は、一般命令語を読み取り、実行する間後続する拡張命令語を処理することによって、後続する拡張命令語の後の一般命令語を直ちに処理することができ、拡張命令語方式の中央処理装置の性能を増大させることができる。

【図面の簡単な説明】

【図1】拡張命令語の動作図。

【図2】本発明の拡張命令語縮約装置を示すブロック図。

【図3】図2の本発明の拡張命令語縮約装置の動作タイミング図。

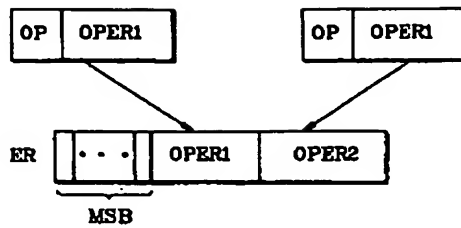
【図4】図2の本発明の拡張命令語縮約装置の他の動作タイミング図。

【符号の説明】

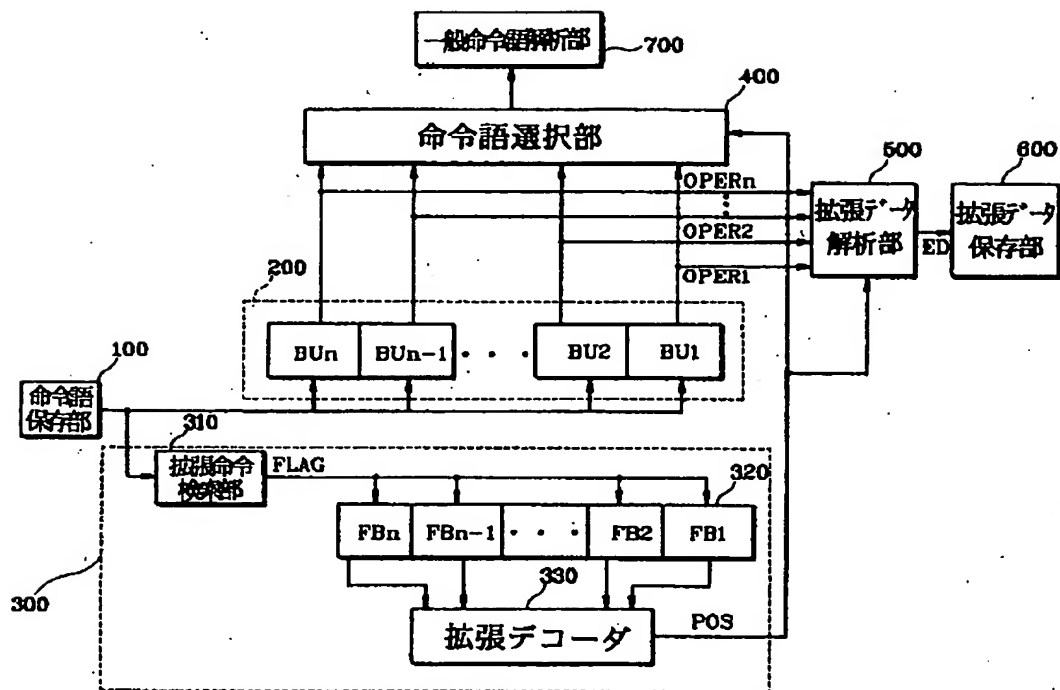
100…命令語保存部  
200…臨時保存部  
300…命令語検索部  
310…拡張命令検索部  
320…フラグレジスタ  
330…拡張デコーダ  
400…命令語選択部  
500…拡張データ解析部  
600…拡張データ保存部  
700…一般命令語解析部  
POS…位置信号  
BU1～BU<sub>n</sub>…バッファ  
ED…拡張データ  
FLAG…フラグ信号  
FB1～FB<sub>n</sub>…ラグビット  
OPER1～OPER<sub>n</sub>…被演算子  
PF…プリフェッチ  
IF…デコード  
EX…実行

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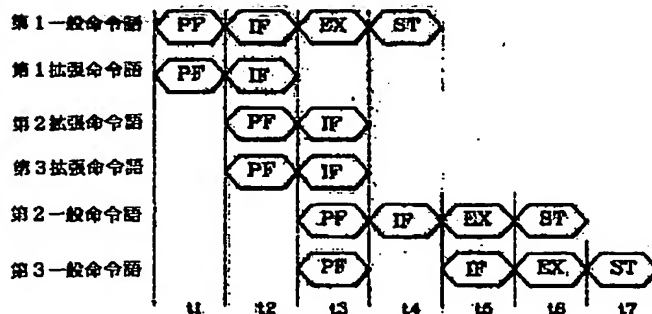
【図1】



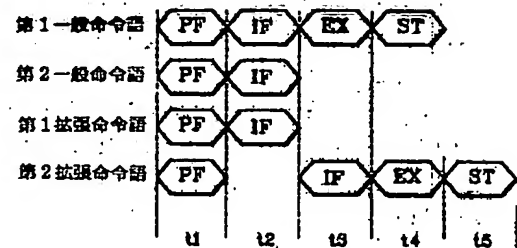
【図2】



【図3】



【図4】



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